And then they asked, "What exactly is the HerndonHS/ NASAHQ Robotics Team?"

To which we proudly replied:

Our Team

Team 116, Its Composition, and Its Spirit

Two distinct components drive our team at Herndon: a group of creative, artistic members whose dreams we turn into realities and whose thinking always exceeds the boundaries of common problem-solving; and a group of logicians who improve upon existing ideas, attempt to objectively select the most suitable design, and then actually build that design. From a philosophical viewpoint, the team serves as an allegory of the components of human intelligence itself that one can ponder indefinitely. From an engineer's perspective, however, our team operates as the ideal engineering environment. Admittedly and obviously, we do not always arrive at the best solutions, but one should attribute that to our lack of experience, and what we lack in experience we make up for in enthusiasm: enthusiasm for learning, enthusiasm for creativity, enthusiasm for logic, and enthusiasm for the engineering process.

The Adults

Mature adults teaching us the ways of life

The HHS/NASAHQ Robotics team is blessed to possess committed teachers, engineers, and parents who deeply dedicate themselves to our goals. They have joined forces to make a difference in our lives by demonstrating teamwork and perseverance.

Mr. Kemp joined our robotics team because his son, Eric, wants to be an engineer in the space program after college. "I enjoy doing things with my son and this was a great opportunity to get involved in something together," he said.

Mr. Koberg also joined for the benefit of his son, Seth. From Mr. Koberg, we learn welding techniques, and he also and aids significantly in the robot's construction.

The adults involved have been impressed with our positive attitudes and our ability to work together. They said that even though the adults didn't think that they possessed enough engineering experience, they felt that they were major influences on the team. When Mrs. Murtland's son, Chris, asked her to join, she hesitated because she felt she knew nothing about robots. However, her background in the travel industry has helped us immensely. She coordinates the National and Regional trips, learns more about robotics and engineering, and spends more time with her son – all of which she enjoys. Mrs. Murtland comments: "I have learned that teens are WONDERFUL! I have also learned that engineers are a little "nutty"!" J

Anxious about exploring applications of mathematics, Mrs. Bobzien and Mr. O'Connor, math teachers at Herndon, have also aided the robotics team. Mr. O'Connor thinks: "whenever you can get adult experts together with students to collaborate on a project, it makes for a very rich learning opportunity for everyone." Both math teachers help Mr. Tripp, our inspiring sponsor, with supervision and are thoroughly pleased with the intelligence and talent of the students on the team. Mrs. Bobzien insists: "I enjoy getting to know and interact with the students in this hands-on environment."

Mr. Johnson, a physics teacher at Herndon, joined the team to assist Mr. Tripp. He also

The Adults (cont.)

"wanted to see how NASA engineers would guide students toward design and fabrication of the robot." In his Army experience, he worked with an acquisition of weapons systems and interfaced with program managers and their staffs. He wanted to apply his knowledge of the steps and stages of Army Research and Development, while observing how students would react under the demands of building a robot that would accomplish its mission. Mr. Johnson also wanted to "work with the students, help them where possible, and watch them have fun."

Mr. Wetzel loves creating things and tinkering. He contributes his supervision and guidance on project management while having fun and learning. Mr. Vora finds robotics a "gratifying experience" and is "really impressed with the dedication, team work, and coordination among all Weasels."

Mrs. Bobzien put it best when she said: "In spite of the deadlines and long hours, this is a worthwhile project that I would not have missed for the world."

Students, teachers, and parents are not the only constituents of the Robotics Team. There are also engineers, taking time out of their busy schedules to help us build the robot. We students have often wondered where they kept those incredible reserves of patience and wisdom needed to stick with us all through the year. Each of the engineers have fascinating motives for joining the team, ranging from learning about a different aspect of robotics than they are used to working with to getting free pizza.

When asked why he was here, Joe Parrish, an aerospace engineer for NASA, and Jeff Meech, systems engineer for Lockheed Martin, immediately quipped that they were dragged into this. Later, Joe added solemnly, he enjoyed “knowing that I made a difference.” Jeff chimed in saying that he wants to make use of his degree and wishes to help us work things out at the same time.

Dave Lavery, the Program Executive for Solar System Exploration at NASA, said in a much lighter tone with a small smile tugging at the corners of his mouth, “My wife won’t let me stay home at night.” As an alumnus of Herndon HS, he also wanted to give back to the community from which he had come. “It is fundamentally important,” he added, “to increase science and technology education in the country if we’re going to remain economically competitive.”

Steve Brown joined last year because his daughter was on the team. He loved the experience so much that he came back this year, even though his daughter had already graduated. He found that the ideals of FIRST resounded within him, that the true role models of today’s generation should be the scientists, doctors, teachers and engineers. By volunteering, he is doing his part to bring about a change, which is incredibly important in our society.

The Adults (cont.)

All of the engineers agreed on one thing: the single most important reason for being part of FIRST and the Robotics Team is being with us, the students. Jack Oelschlager enjoys teaching us the practical aspect of building things and how to translate conceptual ideas into the real thing. Mark Thoreson, another former student of Herndon HS, wanted to help us achieve our goals and to “impart some kernel of my modicum of wisdom to the younger generation and in the end inspire them.”

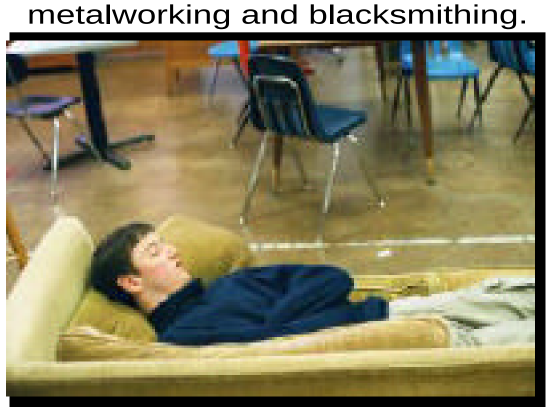
Mike Wherley summed it up. “I like to help kids. I love teaching. I like to bring knowledge to students and help them have an appreciation for their minds.”

During the non-school hours of our lives, we find ourselves somehow attracted to the ugly brick institution like moths to a porchlight on a humid summer's night. We come to the shop, our second home, to participate in the HHS/NASAHQ Robotics team. Our backgrounds vary—our goals for the future range from the expected aspirations to be engineers and computer scientists to brain surgery, philosophy, and music—but we unite for one sole reason: to build a functional robot capable of performing multiple tasks and competing in the FIRST competition.

We come nearly every day, stopping only to grab a quick bite of pizza and to catch the occasional nap. We sacrifice our precious weekends, even to the extent of rising at the ungodly hour of 9 am, giving ourselves enough time for the robot's creation. The old mailman saying, "Neither rain, nor sleet, nor snow," proved perfectly applicable to our case: we frequently found ourselves trekking through mountains of snow and ice on all four of our

This year we saw an increase in the number of members participating, especially among the underclassmen. Seven of the eight remaining former team members have returned to work with us. It seemed to break even in the end, however, as one former member, Stephen Snyder, now a freshman in college, returned but this time as an engineer. Another former member, Alisha Wallenstein, parted the team to go to college and started her own robotics team there. When asked what possessed them to rejoin the team, they answered thus:

Jacob Selmer, our team captain, aimed to be a professional trombonist but discovered his special talent in building things through the FIRST program. He plugs his newfound knowledge from designing and building the robot into his personal hobbies, metalworking and blacksmithing.



"The world of engineering has been opened up to me through both the people and the skills that will help me to continue," he says, recounting on how being the Team Captain has helped him learn how to manage a large-scale project. "I have the opportunity to work with the rest of the team, which includes other students at all ages and experience levels, and a lot of professional

Student Members (cont.)

The Aspirations of Today's Youth

Also joining again for the experience in engineering are Chris Murtland, leader of the basket subteam, and Russell Devine, member of the lift subteam. "The robotics team is the best team I've ever been on," Chris says enthusiastically, "I also gained a lot in the way of mechanical inclination, and decided that this is what I want to do for a living." Russell agrees. "While it might seem [like] a waste of time to some people when you show the finished robot off, if we make just a few more think about robotics or engineering, then the goals of FIRST are being accomplished, " he stated. "Also, as much time and pressure as it is to get the robot done in six weeks, you ***do*** get to have Florida," he added with a wide grin.

Mike Chen, a member of the animation team, rejoined because, "I love robotics. As much work as I had to do last year, I had twice as much fun, even though now I am getting only a quarter of sleep."

The self-proclaimed Goddess of the Lathe, Ruth Dickey, enjoys the maddening pace of the building process. "Inspire me!" she shouted, while deftly crafting a small gear.

Farrah Dang, the gifted artist and animation team lead, joined the HHS/NASAHQ Robotics team as a result of a little peer persuasion, but stuck to it when she found that there was an animation team. "I love computer graphics and it was an opportunity to better my graphics skills," she reasoned, but then added quite slyly, "And we get to use software that's almost completely inaccessable to students because of its price range." She decided to stick with the team to further her computer graphics skills.

Eager to compete and meet new people, Peter Jaffe, mobility base leader and member of Chairman's Award, says, "I return to the HHS/NASAHQ FIRST Robotics team for love of competition and cooperation." He not only loves the math, science, engineering, and especially creativity that go along with the FIRST competition, but he values his unique relationships with others—not only as teammates, but also as co-workers and co-pupils.

Overall, the FIRST competition profoundly impacts our lives. Though we tend to be stressed and possibly a bit grumpy through those strenuous six weeks allotted to create the robot, all of us, old member or new, can only find good in the whole experience.

It seemed like a normal meeting for the Robotics Team: come in, sit down and wait for the fun to begin. Little did we realize how much fun had been intended for us that night—-well, fun for the engineers who happened to be watching. Dave, with his usual energy, bounded to the front of the room, a mischievous gleam in his eyes. The members from last year briefly remarked about trouble brewing, but we "newbies" disregarded the wise warning. It was not long before our leaders herded us from the room into the more spacious hallway.

Each of us joined a group of people with whom to work. We milled about for a few minutes wondering what Dave had in store for us. Soon however, Dave handed each of us a blindfold. Blinded, we attempted to remain in our groups, then something small, thin, and somewhat scratchy fell into our hands. No, it was not a piece of Mr. Tripp's beard (the subject of a story told later) woven into a thin line; it was a piece of twine tied into a loop.

Again we stood around, rather puzzled by the random events unfolding around us. Dave's voice cut through to our somewhat muddled senses. "Attempt to make a square," he said, "in as little time as possible."

For a few minutes, our group worked to determine the placement of our members, extending arms and hands, and estimating the space between our fists while holding the twine taught. Slowly, we talked it out, getting some members of our team against a wall, and others to touch their hands and stand directly across from them. Backing up slowly, we pulled the string taught and hoped for the best. Announcing we were ready, we pulled off our blindfolds and...

We assembled a trapezoid of some sort, although it certainly fails the definition of a square. The entire

point, Dave explained, was teamwork: the activity taught us to communicate effectively and efficiently; it worked, to a degree. We each walked away fully realizing how difficult effective communication can be, and possessing the ability to defeat communication barriers with logic and the agility of our minds.

Teamwork --- A Frayed Knot

The Human Knot

Uncle Milo

Who says you can't learn anything from your relatives?

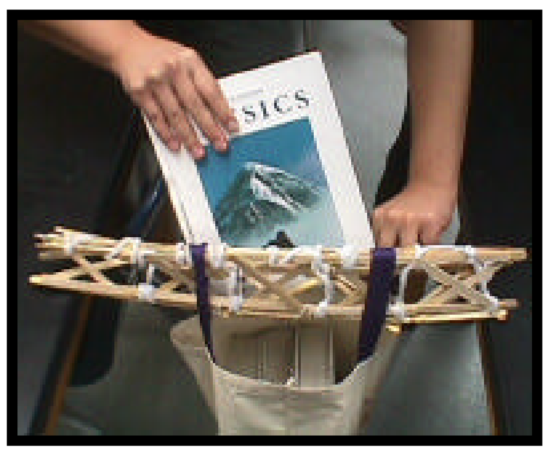
Leaping over fallen branches and stepping over stones with amazing agility, old Uncle Milo fled from the Really Scary and Vicious Rabid Dog. Suddenly, the earth parted and a great chasm appeared before him. What would he do?

White-knuckled and gripping the edges of our seats, the team wondered what would happen to poor Uncle Milo. Dave, storyteller extraordinaire grinned at us, and we peered cautiously into the mysterious paper bags passed out to us at the beginning of the meeting. Dave continued the story.

Each bag represented a backpack containing all of Uncle Milo's worldly possessions. The Really Scary and Vicious Rabid dog would take forty-five minutes to reach Uncle Milo, wile we, working in groups of four, had the job of building him a durable bridge, capable of transporting Uncle Milo and his worldly possessions. However, as this was but a story, and we only had the meager supplies in the classroom to use, the actual materials and the circumstances had to be modified. In lieu of the worldly possessions and Uncle Milo, we placed big, fat, terrifingly thick physics textbooks on scant bridges made from a combination of popsicle sticks, wood glue, pipe cleaners, and a white balloon (?!). In the time allotted, we all managed to engineer some sort of structure or another for Uncle Milo to cross on.

In this exercise, we learned that:

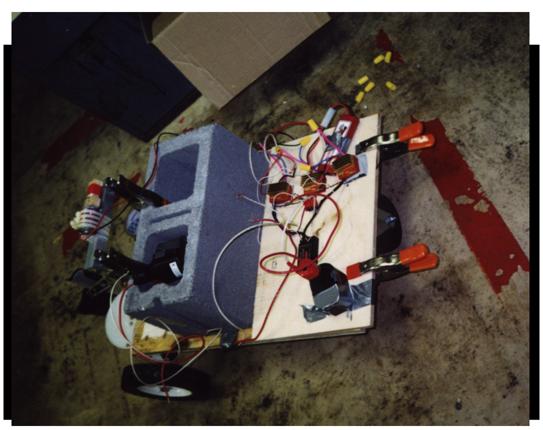
1) Triangles are very structurally sound,
2) Four heads ARE indeed better than one,
3) Our engineers aren't as scary as they initially seemed, and
4) Never to wander through the woods, old and alone, with all your worldly possessions.



Groups of students huddled in small groups were scattered about the shop, each expertly fixing and tweaking their prototype to perfection: "Hey, pass me the needle-nose pliers, would you?" ... "The needle-nose what?"

The assignment was simple, and the requirements were few: design and build a robot capable of dodging a few obstacles and retrieving a can of coke. There would be four teams in this competition, each supervised by an engineer. With that, the team leaders provided each team a crate of supplies, and set them loose in the shop.

Students and engineers worked together to generate ideas, evaluate them, improve the design, and actually build the robots. After four weeks of construction at an awe-inspiring pace, the competition began. Engineers, students, and teachers pooled into the hallway. They followed in a silent procession the driver who carefully maneuvered the robot with a radio transmitter. At length, the first robot approached the can of Diet Coke. Rearing back, the little robot ran into the can at full force, spearing it with an assortment of screws on the front and lifting it. Sighs of relief from that team and shouts amazement from the other teams echoed as the robot triumphantly brought the slightly dilapidated can back into the shop.



Outreach

Our Trip to Willow Springs Elementary School

The HHS/NASAHQ Robotics team recently embarked upon a journey to Willow Springs Elementary School in the neighboring city of Fairfax. There awaited a group of students in the SACC (School-Aged Child Care) program. After a bit of preparations, we began our presentation, explaining the FIRST robotics competition to the students. Our captain, Jacob Selmer, mused upon the subject of engineering with the students, emphasizing the influence of his school-provided education on his ability to participate in this competition. We launched into an introduction of last year's game, showing the students the floppies and describing the process by which the team engineered SECOND, last year's robot. Finally, we presented the details of our team this year, stressing preparation as a key element to a successful team. In this discussion, we introduced the most important part of the presentation: our preparation for the FIRST competition in the form of the autumn prototypes.

At last, we had gained the attention of our students: Jacob described our "prototyping" process. In an effort to educate our new members and further develop the minds of our returning members, Dave Lavery presented several groups with a simple challenge: to build a robot that could fit through a standard doorway, maneuver around random objects strewn throughout the hallway, and pick up an aluminum can—while carrying a formidably heavy cinder block. We posed this challenge to the students, who answered with the standard ideas: a robot with an arm or a claw. Heather Schulke, a new member this year, pointed out the advantage of strong ideas and "thinking outside the box," hence dispelling the notion that bad ideas existed in the brainstorming phase. The students took that idea and ran with it, springing forth new creative ideas from every crevice of their minds. Some suggested giant magnets, javelins attached to a string: in both cases, the students attempted to entice the can to move without significant movement on the robot.

It was then that Heather rolled out her group's solution. Mike Chen, a returning member, pointed to the row of screws on the front of the robot that could spear the can, explaining that simplicity enhances the efficiency of most mechanisms, the engineering parallel to Occam's Razor. To demonstrate, Heather drove robot against a plastic Sprite can, pinning it against the wall and securely affixing it to the front screws. The eyes of every student lit up.

South Lakes

Teamwork and Cooperation on the Local Level

South Lakes High School

Before sponsoring Herndon High School's robotics team, NASA Headquarters sponsored neighboring South Lakes High School both fiscally and with the skills of engineers such as Dave Lavery and Joe Parrish. When NASA decided to discontinue support for the South Lakes program and appropriate funding for the Herndon program, it brought with it a wealth of other support, including several other engineers who had worked with the 'mother' program. Even our team number, 116, originated at South Lakes. With these obvious reminders of our team's origins, we have striven to maintain a close link to our predecessor South Lakes High School.

In the 1999 FIRST Competition, South Lakes managed to acquire funding to attend the Philadelphia regional competition. There, placed across the aisle from our team, SLHS had a direct opportunity to interact with Herndon High School. One Herndon student had spent a year at South Lakes and thus knew most of SLHS's program, and the program director at SLHS and many of the students there had spent three years working with the engineers now at Herndon. These factors provided an optimum environment for positive cooperation. First, the Herndon team aided the financial situation of South Lakes by attending the New Hampshire kickoff for the leaders of SLHS; then, Herndon and South Lakes held a joint kickoff meeting for the members that following Sunday morning. At the events, the teams supplied knowledge, tools, and suggestions for each other and rooted for each other. Our cooperation quickly evolved into a symbiotic relation in which Herndon, the more well funded team provided tools and resources for South Lakes; and South Lakes, a team with more experience, provided Herndon with ideas and suggestions that were desperately needed. Later that year, at the KIPR 1999 Botball competition, the SLHS and HHS teams continued this productive relationship by sharing tools, resources, and team spirit.

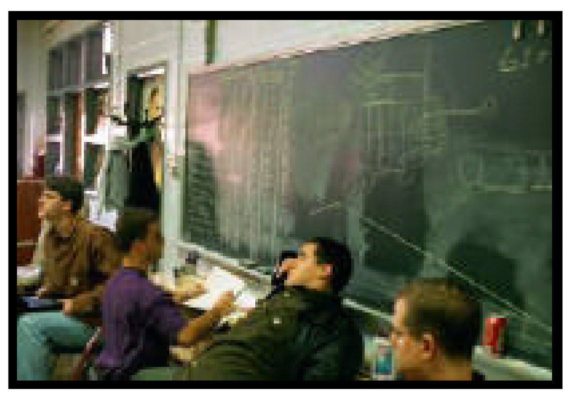
Following the dissolution of the FIRST robotics team for the year 2000 competition, the program director at South Lakes offered a majority of the team's supplies for use at Herndon High School. A team of one engineer and three students spent an afternoon at the neighboring high school collecting and organizing supplies for transport, while simultaneously sharing in a highly emotional day of recollection of the South Lakes robotics program, in which the present engineer and one of the present students had participated. Upon leaving with the supplies, the robotics team at South Lakes had officially ended, having fed the last of its strength into the Herndon High School Robotics Team.

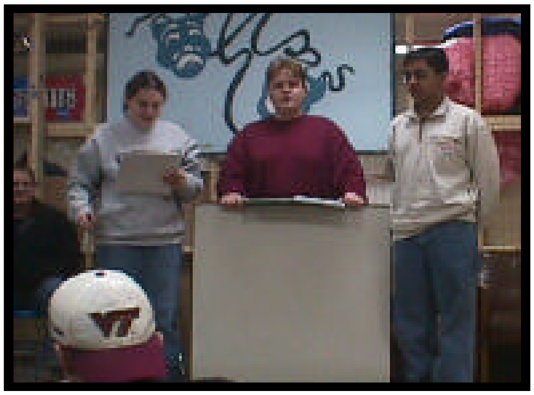
Brainstorming

The brainstorming of robot designs proved to be one of the most important meetings we held in the project's initial steps. To ensure that everybody had a chance to voice their ideas and so that we would have as many different designs as we could to choose from, the team broke into small groups.

We started out by writing down ten ideas for either the robot or major subsystems. We tossed all of the obviously hare-brained schemes out of the way. Once these ideas were shared we left them behind and went into the real brainstorming. The first thing we had to get into our heads, as Dave kept reminding us, was that "there is no such thing as a bad idea." This is where we abandoned all thought of practicality, expense, and the laws of physics. The small groups discussed whatever strange ideas came to mind and kept a list of design concepts they had. This second group of designs presented to the team was the next step away from sanity. These ideas ranged from bulldozers, hooks locking onto the 10-point bar, suction cups and crab claws, to robots with suspension systems, grappling hooks, high power vacuums, and jumping, flying, climbing, self-righting, and self-destruct abilities.

Our next step was to take a list of random words generated by Dave, and come up with designs that included those items. This forced us to become more inventive. Words included things such as dice, teddy bear, pistol, key, and litter box. We concocted robots with shoes to kick the balls, TV remotes in the player station, flash paper to distract others, and a stoplight to indicate when the lift system finished rising. Our design for the litter box is still a secret though. Here we found that even if there is no such thing as a bad idea, some of them get very close. By thinking of all of these different ideas, we selected favorable designs and incorporate those ideas into our strategy and final design.



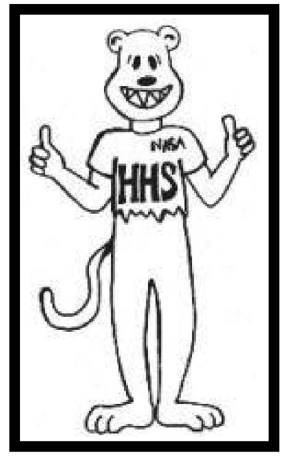


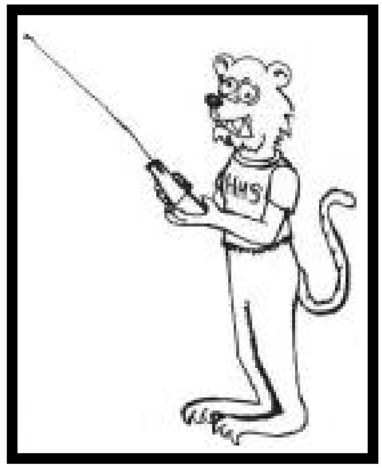
Fun and games completed, our abstract designs for robots presented themselves before us for review. The arduous task of selecting one of eight presented itself as well. The creative processes completed, we established a set of criteria, based upon our chosen strategies for the game, upon which every robot would be evaluated. After expanding the specifics of each criterion, the team came together to choose. Spending almost six hours, we examined each robot, presenting advice and criticism for each design, and finally judging each robot based upon its strengths and weaknesses. At the beginning of this process, a select group of returning members participated, but as time wore on and one would expect fatigue to set in, the other members of the team found the desire and courage to speak up, and offered important advice and opinions. By the end of the process, we had incorporated all members of the team into a glorious opus of individuals working together to design our robot, and our selected design represents that: it is an opus of individual, original thoughts coming together in the Herndon High School / NASA Headquarters Robotics team.

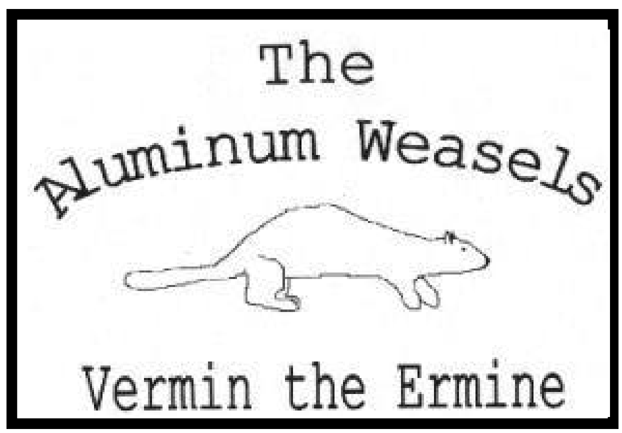
Criteria Evaluation

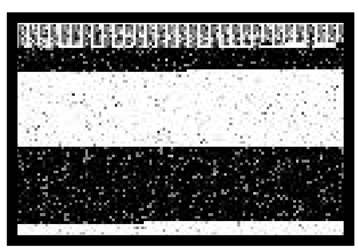
Our Team Logo

Glenann, the heroine of our slightly artistically-challenged ensemble, enthusiastically took charge of our team's logo design process. Team members carefully studied and evaluated each design, carefully considered the choices, and finally voted for logos that corresponded to our chosen theme: "Vermin the Ermine—The Aluminum Weasels." In a strange twist of fate, however, the awe-inspired Hornet—also Herndon High School's mascot—stole the hearts of our robotics community. We selected the fearful Hornet in hopes of intimidating other teams, or at least, for a clever decoration for our team uniforms.









Web Team

The web team keeps the rest of the team "in the know." It's a very trying job that requires its members to update the pages right after the meeting so absentees can stay updated on the ongoing activities. For this reason it is worth every bit of sweat and frustration that goes into hammering out the code on the web site. We devote these late nights for the rest of the team, and that is rewarding in itself.

But the job is more than just working on the web. The Internet is one of the many gateways to the future explored by the team. In a sense, we are all on the forefront by participating, and here too is the challenge of learning. We are working with a medium we will need to know in the future, and we're not doing it alone. We help each other with this bit of code, or that bit of description as a team. And, luckily, we have Mike Wherley, someone who works on and designs web pages for a living, willing to look over our code and teach us what we don't know or understand. It's a very nurturing environment.

At the same time, it is a good experience for learning how to deal with real world situations such as deadlines. It is an interesting experience for us to have people depending on how thorough we are when investigating what stage each subteam has reached or how often we can update the page. Most of all, it is about fun. Working on the web page is something we all enjoy doing.

Integration

The members of the integration team have the honor of controlling the robot's destiny. Though stressful at times, this has proven to be a surprisingly enjoyable experience for all involved. The position allows us to interact with every member of the team (also strenuous), and we get a more complete understanding of the robot. Understandably, the stress of this particular job can take its toll, but in the end, we can definitely say that it was all worth it; because of our experiences with the FIRST competition, we have improved upon social and time management skills, while at the same time gaining a greater appreciation for the process involved with robotics engineering.

Subteams (cont.)

Basket

Working on the team has taught me to deal with other people. At first, the prospect of spending the next six weeks with the same people daunted me. Would I be able to stomach the other team members and their foibles, their deodorant, the scent of their favorite food on their breaths? More importantly, will they be able to stomach mine? Fortunately, the task of building a basket system shadowed everything else. Within a week, we scrambled to start building the basket which had to rise high enough to dump the balls into the trough, then hook itself onto a bar and lift the 130 pound robot above the ground. To solve this, we created a scissors lift that, as it squeezes together, raises the basket. Once the basket reaches five and a half feet, the door to the basket opens, much like a dump truck, and pours the balls into the trough. The basket problem almost turned us into basketcases. All however, worked out in the end.

Lift

The wonderous, marvelous lift. The charming mechanism by which our robot places the balls into the goal. As there are height restrictions (alas, no Godzillas here) limiting the initial height of the robot to five feet or under, we designed a scissors-lift that would allow the robot to fit the requirements. The lift is designed to raise the basket up to approximately six feet to enable the robot to dump the balls into the goal. The system will also, theoretically, lift the robot daintily off the ground after we set it on the bar. Our system is the key element in any scoring the robot will do (yes, we are the best).

Push Over

The absence of the push over mechanism would render our robot immobile: in order to fit into the initial dimensions, we begin on our backside without any wheels touching the ground. The first function of the robot is to fall over purposely. To accomplish this, we use a combination of gas springs and a “cam” on the window motor. The push over subsystem is dealing with the location of the center of gravity: the entire system depends on where the center of gravity is, and how we can tip it enough to fall over in the direction desired. This design requires a comprehensive understanding of trigonometry and a close communication with the other subsystems in order to function properly.

Mobility Base

The mobility base group designs the system by which the robot navigates the playing field of the competition. This task takes on extreme difficulty when the field includes ramps, bars to run underneath, and the team's selected design requires the robot to fall from a height of almost five feet! Our problems began when the ball acquisition misinformed us that they required only seventeen inches in vertical space, when they required no less than twenty-nine inches of vertical space, or an additional eighteen inches of horizontal space. In light of our constraints, we shortened our wheel base from forty-eight inches to thirty-two and a half inches, an enormous alteration to our plans. The group bit the bullet and redesigned once again. This change, however, proved beneficial: it eased our turning constraints, it eased our height restraints, and we could now consolidate and simplify our designs considerably. We then encountered significant problems with the "pushover" group that pushed our robot from an upright position at the beginning of the game. They very much lacked direction with which they could reach their goal: in short, they continually changed our design constraints. This problem failed to resolve itself until we organized a meeting of the leaders of every group in a quiet, secluded place. There, without the constant interruption of trivial matters, and at great length, the details of the mobility base solidified.

Control System

Fundamentally, the control system group creates the brain of the robot: a system by which human beings can interject their intelligence into a machine. This task requires a substantially different mindset than that of the other subsystem groups. For instance, even psychology enters the discussion when the control system faces many of their problems: how does one build human controls simple enough for the driver when under stress, but also robust enough to effectively control all aspects of the robot? Beyond psychology, in the technical realm, how can we manipulate the paths of billions of minute electrons in such a way that the robot turns, extends, articulates movements, and accept user commands? Simple wiring skills, including soldering and circuit design, become a basic requirement for control system designers, and a grasp of programming and logic forms the basis of each students abilities.